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ABSTRACT

This course is a laboratory approach to linear measurement, perimeter, circumference, area of square and rectangle, volume of rectangular solids, and fluid measurement. Applications include use of ruler, meter stick, thermometer, beaker, air gauge, geometric solids, and geoboards. After lists of overall goals, overall strategies, specific performance objectives, and scope, the guide gives suggested strategies, materials, and references for twelve units. Also included are sample test items and an annotated bibliography of state-adopted and other textbooks. (MM)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

Mathematics: MEASUREMENT LAB 5212.10
5213.10

DIVISION OF INSTRUCTION • 1971

QUINMESTER MATHEMATICS

COURSE OF STUDY

FOR

MEASUREMENT LAB

5212.10
5213.10

(EXPERIMENTAL)

Written by

James A. Burns

for the

DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida 33132
1971-72

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PREFACE

The following course of study has been designed to set a <u>minimum standard</u> for student performance after exposure to the material described and to specify sources which can be the basis for the planning of daily activities by the teacher. There has been no attempt to prescribe teaching strategies; those strategies listed are merely suggestions which have proved successful at some time for some class.

The course sequence is suggested as a guide: an individual teacher should feel free to rearrange the sequence whenever other alternatives seem more desirable. Since the course content represents a <u>minimum</u>, a teacher should feel free to add to the content specified.

Any comments and/or suggestions which will help to improve the existing curriculum will be appreciated. Please direct your remarks to the Consultant for Mathematics.

All courses of study have been edited by a subcommittee of the 1970-71 Mathematics Advisory Committee.

CATALOGUE DESCRIPTION

A laboratory approach to introduce linear measurement, perimeter, circumference, area of square and rectangle, volume of rectangular solids, and fluid measurement. Applications include use of ruler, meter stick, thermometer, beaker, air gauge, geometric solids, and geoboards.

Designed for the student who has acquired basic computational skills with positive rational numbers.

TABLE OF CONTENTS

OVERALL GOALS

The student will

1. become familiar with a variety of units of measure and a variety of measuring instruments.

2. learn to select and use appropriate units and devices for measuring various kinds of objects and materials.

3. increase his ability to use formulas for finding areas and volumes of plane and solid figures.

4. maintain and improve his performance of arithmetic skills with rational numbers.

5. develop understanding of π and its relationship to circles.

6. develop understanding and use of proportion.

INSTRUCTIONAL STRATEGIES

1. To provide a variety of laboratory exercises integrated with skill building activities.

2. To incorporate verbal problems (with appropriate vocabulary and short sentences) in every phase of the course.

3. To provide ample opportunity daily for the youngsters to estimate answers to problems.

4. To incorporate ratio and proportion in every phase of the course.

Special Note to the Teacher

Before beginning this course be sure to read "Advice on Organizing a Math Lab," pages iv-vii, in Buckeye, et al, A Cloudburst of Math Lab Experiments, Volume 2.

KEY TO REFERENCES

State Adopted

F-P-G - Foley, Jack; Jacobs, Wayne; and Basten, Elizabeth. Discovery and Structure, Geometry: Measurement and Measures. Menlo Park, California: Addison-Wesley Publishing Company. 1970.

F-P-M - Foley, Jack; Jacobs, Wayne; and Basten, Elizabeth. Patterns and Discovery. Measurement and Measures: Area and Volume Measure. Menlo Park, California: Addison-Wesley Publishing Company, 1970.

F-P-L - Foley, Jack; Jacobs, Wayne; and Basten, Elizabeth. Patterns and Discovery. Measurement and Measures: Linear Measure. Menlo Park, California: Addison-Wesley Publishing Company, 1970.

F-P-A - Foley, Jack; Jacobs, Wayne; and Basten, Elizabeth. Angles and Patterns. Angles: Measurement and Measures. Menlo Park, California: Addison-Wesley Publishing Company, 1970.

F-P-M - Foley, Jack; Jacobs, Wayne; and Basten, Elizabeth. Angles and Patterns, Metric Geometry: Linear, Area, and Volume Measure. Menlo Park, California: Addison-Wesley Publishing Company. 1970.

AIM(LM) - Johnson, Donovan; Hansen, Viggo; Peterson, Wayne; Rudnick, Jesse; Cleveland, Ray; and Bolster, L. Carey. Activities in Mathematics. First Course: Measurement. Glenview, Illinois: Scott, Foresman and Company, 1971.

Sbl(1) - Sobel, Max; Maletsky, Evan; and Hill, Thomas. Essentials of Mathematics 1. Boston: Ginn and Company, 1970.

Sbl(2) - Sobel, Max; Maletsky, Evan; and Hill, Thomas. Essentials of Mathematics 2. Boston: Ginn and Company, 1970.

... - ... Nanney, J. Louis; and ... Agnes. ... Mathematics I. New York: The L. W. Singer Company, Inc., 1...

...(...) - ..., Elizabeth; Nanney, J. Louis; and Hickey, Agnes. ... Mathematics II. New York: The L. W. Singer Company, Inc., 1...

...(1) - ... Ideas in Mathematical Ideas. Volume 1 ...(2) ... Washington: National Council of Teachers of Mathematics, 1...

...(2) - ..., Donald; Edwards, William; and Ginther, John. ... Laboratory Mathematics Experiments. Volume 2. ..., Michigan: Midwest Publications, 1971.

PERFORMANCE OBJECTIVES

The student will

1. Define a unit of measure appropriate to a given object and use it to measure the object.

2. Give examples of units commonly used in everyday life.

3. Explain the need for different kinds of units of measure.

4. Select a standard unit appropriate for the measurement of a given object or material.

5. Find the measure to the nearest 1/8 of an inch a given line.

6. Find the linear measurements of a given plane figure using a meter stick, 12-inch ruler, or measuring tape, whichever is most appropriate.

7. Find the linear measurements of a given solid figure using a meter stick, 12-inch ruler, or measuring tape, whichever is most appropriate.

8. Calculate the perimeter of a polygon where the dimensions are given.

9. Calculate the area when given the dimensions of
   a. a square
   b. a rectangle
   c. a triangle
   d. a circle (and the formula $A = \pi r^2$)

10. Calculate the volume when given the cimensions of
    a. a cube
    b. a rectangular solid
    c. a cylinder (and the formula $V = 2\pi rh$)
    d. a cone (and the formula $V = \frac{1}{3} B h$)

11. Define π as the ratio of the circumference of a circle to its diameter.

12. Calculate the circumference of a circle when given the measure of the diameter or radius and the formula $C = \pi d$.

13. Calculate the approximate length of the diameter of a circle when given the measure of the circumference, the formula $C = \pi d$, and a numerical approximation for π.

Performance Objectives (continued)

14. Measure and label with an appropriate unit, the amount (by volume) of sand in a
    a. cube
    b. rectangular solid
    c. cylinder
    d. cone

15. Show by demonstration the relationship between
    a. ounces and cups
    b. cups and pints
    c. pints and quarts
    d. quarts and gallons

16. Read a gauge or meter which is given either in physical or pictorial form.

17. Solve selected word problems involving
    a. measurement
    b. proportion

18. Measure, correct to the nearest degree, the
    a. angles of an acute triangle
    b. angles of an obtuse triangle
    c. angle of a sector of a circle

19. Find the fractional part of the circle when given the angle of a sector of that circle.

20. By measurement and comparison, find the fraction which represents the ratio between two similar figures.

21. When given the ratio between two similar polygons and the dimensions of one, calculate the perimeter of the other.

SCOPE

I. Miscellaneous measuring devices
- A. Scales
- B. Meters
- C. Gauges
- D. Rulers
- E. Calipers
- F. Micrometers
- G. Meter stick
- H. Yard stick

II. Linear measure
- A. Unit of measure
  - 1. Definition
  - 2. Need for different kinds of units
  - 3. Need for standardization
- B. English system
  - 1. Inch
  - 2. Foot
  - 3. Yard
  - 4. Mile
- C. Metric system
  - 1. Millimeter
  - 2. Centimeter
  - 3. Decimeter
  - 4. Meter
  - 5. Kilometer

III. Perimeter
- A. Definition
- B. Calculating perimeters
  - 1. Squares
  - 2. Rectangles
  - 3. Triangles
  - 4. Other polygons

IV. Area
- A. Units of measure
  - 1. Square inch
  - 2. Square centimeter
  - 3. Square foot
  - 4. Square yard
  - 5. Square meter
- B. Calculating areas
  - 1. Squares
  - 2. Rectangles
  - 3. Triangles
  - 4. Circles

V. Volume
- A. Units of measure
  - 1. Cubic inch
  - 2. Cubic centimeter
  - 3. Cubic foot
  - 4. Cubic yard
  - 5. Cubic meter
- B. Calculating volumes
  - 1. Cubes
  - 2. Rectangular solids
  - 3. Cylinders
  - 4. Cones

VI. π (Pi)
- A. Value of
  - 1. Definition
  - 2. By approximation
- B. Calculation with
  - 1. Finding circumference
  - 2. Finding diameter

VII. Angle measure (in degrees)
- A. Acute angle
- B. Obtuse angle

VIII. Fluid measure
- A. Units of measure
  - 1. Ounce
  - 2. Cup
  - 3. Pint
  - 4. Quart
  - 5. Gallon
- B. Calculating

IX. Problem solving

X. Ratio and proportion

XI. Review and practice of arithmetic skills

1. Some measuring devices

The EIMI, Vol. 1, contains excellent lab experiences concerning the very basics of measurement.

The importance of a variety of measuring devices and the need for different kinds of units of measure will gradually become clear as students experiment with different instruments.

Students enjoy such projects as making a spring scale, a transit, a balance scale, or a copy of the electric meter or water meters at home.

Some discussion about automobiles might instill the importance of being able to read gas gauges, air pressure gauges, oil dip stick, speedometer, etc.

History of measurement is good discussion material; see Sbl(1) pages 322-325, 395.

Useful Materials

Electric Meter (or large picture of one)
Rulers (with various scales)
Meter stick
Yard stick
Thermometer
Speedometer
Postal scale
Bathroom scale
Balance scale
Cartons of various sizes
Egg cartons

References
(*state adopted)

	EIMI(1)	*Sbl(1)	EM(E)	*AIM(1M)
pages	104	248-253	124-131	1-10

Sequence, Strategies, Sources (continued)

2. Linear measurement

   a. What is a "unit of measure"?
   b. Using the inch as a unit of measure
   c. Using fractional parts of an inch, such as 1/2, 1/4, 1/8 as a unit of measure
   d. Using a yard stick
   e. Using a measuring tape

The exercises in EIMI(1) can be used to stimulate interest in accuracy.

Provided with a pre-cut strip of cardboard 12 inches long, the student can make his own ruler by marking a prescribed number of equal divisions; trial and error is a good exercise in estimation.

After practicing with a unit of measure, experience in estimating should precede further measuring; i.e., guess the length in beans, inches, feet, yards, etc., then measure. If a record in table form is made, the student can determine whether or not he is a good estimator.

Make activity cards for small group work; for instance, the Qwik-Ride delivery service will take cartons which have a combined girth and height of 96 inches or less; how many of the cartons at hand can be shipped with Qwik-Ride?

Practice translating inches to feet to yards, and vice versa. Refer to The Mathematics Laboratory of McCormick-Mathers or Singer's Individualized Mathematics Drill Kits.

References
(*state adopted)

	EIMI(1)	*Sbl(1)	MLE(2)	*AIM(1M)	*F-PD-LM
pages	106-112	253-263	99-119	11-14 21-26	1-14

Sequence, Strategies, Sources (continued)

3. Squares and rectangles - perimeter

   a. What is perimeter?
   b. Finding perimeter of squares and rectangles
   c. Using a formula for perimeter

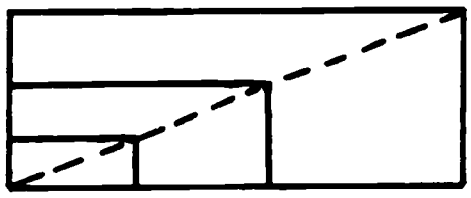
Definitions should be very informal; recognition by example should be sufficient.

For these exercises, use only inches, feet, yards, and fractions thereof.

After measuring a number of rectangles and squares, students will enjoy using a "short cut" to find perimeter; i.e. a formula.

Students will enjoy creating many different rectangles which have a given perimeter.

Involve ratio and proportion in activities. For instance, on enlarging along a diagonal, what happens to the perimeter?



Useful Materials

String
Construction paper
Poster board
Geoboards
Paper cutter
Scissors
Overhead or opaque projector

References
(*state adopted)

	[illegible](1)	EM(E)	*AIM(1M)	*F-SP-MG	*F-DS-G
pages	2[illegible]	140	65-76	12-14	12-15

Sequence, Strategies, Sources (continued)

... [illegible] ratio and proportion

a. Finding the scale
b. Enlarging using squared paper
c. Scale Drawing

The AIM(2), unit 9, pp. 69-95, provides basic experience in the above mentioned topics.

Model airplane kits have good scale drawings.

Reproduction of a favorite comic strip character using ¼" graph paper is an activity most students enjoy.

The use of a pantograph (commercially or student-made) is interesting to many students.

Useful Materials

¼" graph paper
Pantograph

References
(*state adopted)

	Bibl(1)	EM(D)	EM(E)	*F-PD-LM	*AIM(1M)
pages	310-316	88-102 108-111	36-37	15-23	90-94

Sequence, Strategies, Sources (continued)

5. Squares and rectangles - area

    a. What is area?
    b. Finding area of squares and rectangles
    c. Using a formula for area

Definitions should be very informal; units of measure should be stressed.

Restrict units to square inches, square feet, square yards, and fractions thereof.

"Discovery" of the formulas will make them more meaningful.

By making squares of cardboard, students can measure area of chalk boards, floor, doors, etc.

Involve ratio and proportion through enlarging, reducing, and scale drawing. Allow students to experiment with an overhead or opaque projector.

This is a good time to begin a long range project involving the actual construction of a balsa wood model of some part of the school. Measuring, scale drawing, ratio and proportion can all be incorporated.

Useful Materials

¼" squared paper Dot paper
Brown wrapping paper

References
(*state adopted)

	*Sbl(1)	EIMI(1)	EM(E)	*F-DS-G	*F-PD-AV.	*AIM(1M)
pages	264-270	112-115	142	21-26	5-10	77-89

Sequence, Strategies, Cources (continued)

6. Working with boxes

   a. Making your own box
   b. What is volume?
   c. What are some units of measure?
   d. Finding the volume of cubes and other rectangular solids

The EIMI(1) exercises provide an excellent means of developing the concept of volume.

Prescribe certain dimensions, different for each student, so that they may construct a set of boxes to be used in comparing volumes, areas, girth, etc. Covering with wall paper samples may add a note of pride to the project.

Practice in estimating volume can be supplemented by the use of sand for measuring; for instance, estimate the volume of a rectangular solid and then measure by counting the number of cubes of sand needed to fill it.

Toy cubic blocks can be used to build other rectangular solids; they may also be used as a measuring unit.

Useful Materials

Shoe boxes
Milk cartons
Poster board
Paper cutter
Masking tape
Bucket of sand
Toy blocks
Toy bricks
Wall paper samples
Glue
Sample tiles

References
(*state adopted)

	EM(D)	FM(E)	EIMI(1)	*Sbl(1)	*Sbl(2)	*F-PD-AV
pages	146-150	148-149	115-129	272-276	278-289	21-26

Sequence, Strategies, Sources (continued)

7. More work with boxes - surface area - new dimensions

   a. How do you measure the surface?
   b. What is the metric system?
   c. Measuring perimeter, area, and volume with "new" units from the metric system

It is probably not advisable to expect students to make conversions from the English to the metric system (or vice versa). Instead, the purpose of these activities is to develop concepts concerning the uses of the various units. General comparisons can be made; for instance, if you were hungry, would you rather have a cubic centimeter or a cubic inch of ice cream?

Have students make centimeter rulers.

Use the boxes constructed by class members, making new measurements.

Restrict units to millimeters, centimeters, and meters, with squares and cubes thereof.

Using lengths of string measured at one meter, have students make measurements of the length of the room, height of the door, length of the blackboard, etc.

References
(*state adopted)

	*Sbl(2)	EM(5)	*F-SP-MG	*F-PD-AV
pages	198-215	20-23 46	12-31	27-29

Sequence, Strategies, Sources (continued)

8. Going in circles

   a. Using a compass
   b. Dimensions of a circle
   c. π - What is it?
   d. Using formulas to find circumference and area

The parts of a circle can be defined informally by example.

The circumference of a disc may be measured by rolling along a straight line; it is fairly easy to handle and measure the radius of plastic tops, of cans, poker chips, and wheels.

Discovering the relationship between the circumference and the diameter to get π can be done in many ways. One such method is to have students construct a circle on card board or peg board. By placing pins or tacks around the circumference, a string can be used to measure the circumference. Then stretching the string across a diameter, the student will observe that the string will fit three full times with a bit left over. By trying this experiment on circles of different sizes, students will discover the relationship is always the same.

Students may be interested in the history of π; see Eves, History of Mathematics.

The meaning of the formula $C = \pi d$ can be reinforced if the circumference is measured before it is calculated.

The meaning of the formula $A = \pi r^2$ can be reinforced if the area is estimated by counting squares before it is calculated.

Useful Materials

Squared paper	Tin cans
Geoboard	Wheels
Dot paper	Checkers
String	Poker chips
Extra compasses	Pegboard (with golf tees)

References
(*state adopted)

	*Obl(2)	*SRA(1)	EM(D)	EM(E)	*F-PD-LM
pages	216-222	172-174 390-393	114-116	141 146-147	29-31

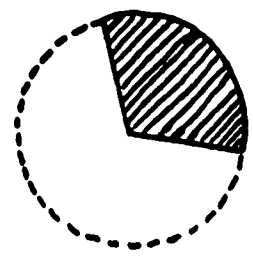
Sequence, Strategies, Sources (continued)

9. Angle measurement

   a. What is an angle?
   b. Using a protractor
   c. Measuring acute angles
   d. Measuring obtuse angles

After practice with measuring a variety of angles, students should be encouraged to estimate.

Finding the area of sectors of circles provides practice in the use of fractions and the formula $A = \pi r^2$.



Useful Materials

Board protractor	Poster board
Paper cutter	Construction paper

References
(*state adopted)

	EM(D)	*Sbl(1)	*GRA(1)	*F-DS-G	*F-SP-A	*AIM(1M)
pages	28-31	294-301	176-184	1-7	3-12 15-19 25-31	43-63

Sequence, Strategies, Sources (continued)

10. More about perimeter and area

    a. Finding perimeter of triangles and other polygons
    b. Developing a formula for the area of a triangle
    c. Finding area of triangles and some regular polygons

Introduce the decimeter and millimeter. Reinforce estimation and measurement with centimeters and meters.

If a meter string is folded into 10 equal lengths, the decimeter becomes instantly visible.

Through the use of a decimeter ruler (in addition to a 12-inch ruler, yard stick, and meter stick), the student should gradually visualize and recall the relative sizes of the millimeter, centimeter, decimeter, meter, inch, foot, and yard.

Useful Materials

Paper cutter	$\frac{1}{4}$" graph paper
Poster board	Dot paper

References
(*state adopted)

	EM(D)	*Sbl(2)	*F-DS-G	*F-SP-MG	*F-PD-AV
pages	50-52	275-233	16-20	3-9 12-23	11-20

Sequences, Strategies, Sources (continued)

11. Fluids and granular substances

    a. How are fluids measured?
    b. Comparison of various units
        (1) ounce and cup
        (2) ounce and pint
        (3) ounce and quart
        (4) pint and quart
        (5) quart and gallon
    c. When are cc used?

Discuss the need for a different kind of unit for measuring fluids.

Students can discover the relationships above by pouring sand or water from one container to another and making a table.

Point out that the word "ounce" is used in connection with weight; therefore, these must be referred to as "fluid ounces."

Introduce the cone and cylinder here. Students are interested in the relative volumes.

Useful Materials

Milk cartons
Plastic bleach containers
Tin cans
Measuring cup
Measuring spoons
Discarded medicine bottles
Bucket

Sequence, Strategies, Sources (continued)

12. A mixture of measurement

Culminating activities should be planned so that students will be called upon to

a. Select units of measure appropriate for a given problem.

b. Determine ratio needed to get certain proportion of area or volume.

c. Use formulas to solve problems.

d. Estimate heights, lengths, areas, and volumes of familiar figures in both English and metric units.

e. Make decisions concerning appropriate measuring devices.

f. Create and solve verbal problems involving measurement and proportion.

SAMPLE TEST ITEMS

For a pretest or a posttest, questions may be selected from the following collection.

To make the results of a pretest more meaningful, it is recommended that there be one day of practice on skills prior to the test.

I. Skill

1. Addition

a. 2057 + 127 + 4002 + 41 =

b. $\frac{1}{4} + \frac{1}{2} =$

c. $2\frac{7}{8} + 3\frac{3}{8} =$

d. 50.73 + 29.1 + 3.002 =

2. Subtraction

a. 2038 − 192 =

b. 4337 − 3105 =

c. $5\frac{3}{5} - 2\frac{1}{5} =$

d. $13\frac{1}{3} - 8\frac{2}{3} =$

e. 29 − 3.12 =

3. Multiplication

a. 528 x 35 =

b. $2 \times 2\frac{1}{4} =$

c. $\frac{8}{5} \times \frac{15}{4} =$

d. 3.09 x 1.2

4. Division

a. $23\overline{)4782}$

b. $\frac{3417}{17}$

c. $\frac{5}{8} \div \frac{15}{4} =$

d. 78.52 ÷ .4

II. Units of measure

Match each item with all units of measure suitable for measuring that item. Note that there may be more than one appropriate unit for an item.

1. Chalk board tray
2. Dress making material
3. Outside house paint
4. Road inclination
5. Track for foot race
6. Pool for swimming race
7. Height of tree
8. Load of soldier's sand
9. Milk
10. Flour for cooking

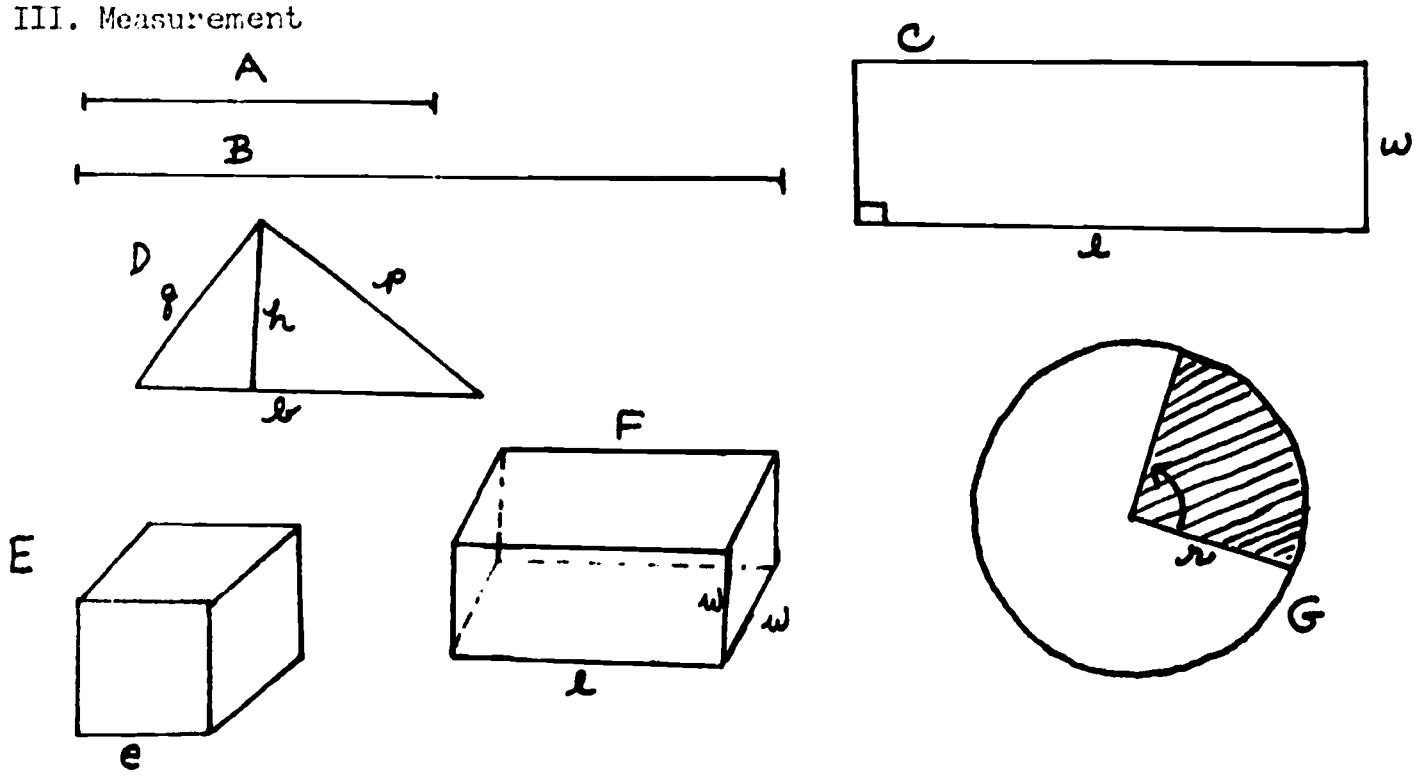
11. Liquid medicine
12. Rubbing alcohol
13. Tube of ointment
14. Hair shampoo
15. Size of bit for drilling a hole
16. Size of auto wrench
17. Oil for car engine
18. Oil for sewing machine
19. String for a kite
20. Depth of water in swimming pool

(Matching items on next page.)

Sample Test Items (continued)
II. Units of measure (continued)

a. inch	g. degree	m. cubic yards
b. foot	h. meter	n. ounce
c. yard	i. centimeter	o. cup
d. pint	j. millimeter	p. square feet
e. quart	k. cubic centimeter	q. square yards
f. gallon	l. cubic feet	

III. Measurement



All questions refer to the figures above. As you work, write the measurements on the figures.

1. Measure A and B to the nearest inch.

2. In rectangle C, measure l and w to the nearest $\frac{1}{4}$ inch.

3. In triangle D, measure h and b to the nearest $\frac{1}{4}$ inch.

4. In triangle D, measure h, b, p, and q to the nearest tenth of a centimeter.

5. In cube E, measure e to the nearest tenth of an inch.

6. In box F (with a square end), measure l and w to the nearest tenth of an inch.

7. In circle G, measure r to the nearest $\frac{1}{4}$ inch.

8. In circle G, measure the angle of the shaded part.

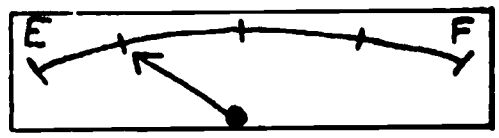
Sample Test Items (continued)

IV. Refer to the drawings in section III. Use your measurements to find the following:

1. The perimeter of C.
2. The area of C.
3. The perimeter of D.
4. The area of D in square centimeters.
5. The surface area of E.
6. The volume of E.
7. The surface area of F.
8. The volume of F.
9. The circumference of G. (Use $C = 2\pi r$ and $\pi = 3.14$)
10. The area of G. (Use $A = \pi r^2$ and $\pi = 3.14$)
11. What fraction of the circle is shaded?

V. 1. Jean has $2\frac{7}{8}$ yards of dress material. The pattern she wishes to use requires $2\frac{1}{4}$ yards. How much material will she have left over?

2. The picture to the right represents the gauge for a gasoline tank. A full tank contains 15 gallons. How much gasoline is left?



3. Make a drawing showing a temperature of 85° F. on a thermometer. The scale should be from 10° to 220°. The drawing should be between 4 inches and 6 inches in length.

4. How many small boxes, 2 in. x 4 in. x 5 in., can be put into a larger box that is 6 in. x 8 in. x 10 in.? Suppose the larger box were only 5 in. x 8 in. x 10 in. How many small boxes would then fit inside?

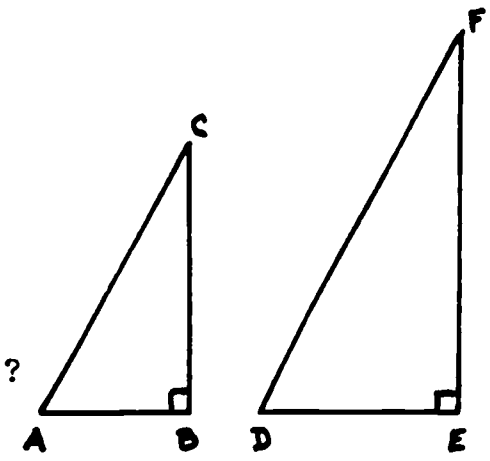
5. If 2 inches on a map represents 25 miles, how many miles is represented by 3 inches?

6. Mary wishes to place a band of red binding around the outside of a circular table cloth. The diameter is 42 inches. How many yards of binding will she need? (Let $\pi = 3\frac{1}{7}$)

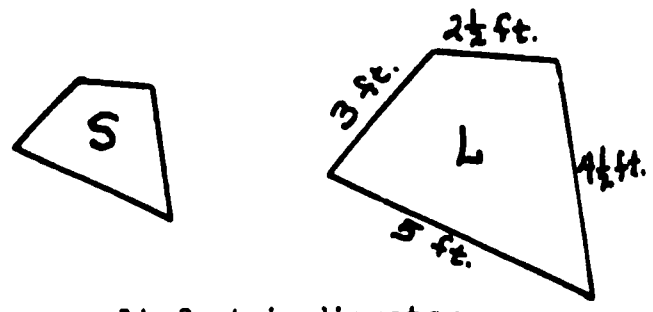
7. Jack measured the circumference of a wheel to be 42 in. and the diameter to be 15 in. Find the value of π according to these measurements. Tell why you think Jack was careful or careless in his measuring.

Sample Test Items (continued)
V. (continued)

8. Measure the sides of the two similar right triangles to the nearest $\frac{1}{8}$ in. What is the ratio of the base of the larger triangle to that of the smaller?



9. The ratio between the perimeter of the two similar polygons S and L is 3 to 5.
   a. Find the perimeter of L.
   b. Find the perimeter of S.



10. A load of sand is in the shape of a cone 14 feet in diameter and 4 feet high.
    a. Find the area of the base. (Let $\pi = \frac{22}{7}$)
    b. Find the volume.
    c. Is there enough sand if 18 cu. yds. are needed? Why?

KEY TO SAMPLE TEST

I. 1. a. 5229
   b. $4\frac{3}{4}$
   c. $6\frac{1}{4}$
   d. 82.832

2. a. 1839
   b. 1232
   c. $3\frac{2}{5}$
   d. $4\frac{4}{3}$
   e. 25.88

3. a. 18,480
   b. 201
   c. $\frac{1}{6}$
   d. 196.3

II. 1. b, c
2. a, c
3. f
4. g
5. c
6. c, h
7. b, c, h
8. l, m
9. d, e, f
10. o
11. k, n
12. d, k, n
13. n
14. d, n
15. a, j
16. a, j
17. d, e
18. n
19. b, c
20. b

Key to Sample Test (continued)

III. 1. A = 2 in.
B = 3 in.

2. ℓ = $2\frac{1}{4}$ in.
w = $\frac{1}{4}$ in.

3. h = $\frac{3}{4}$ in.
b = $1\frac{2}{4}$ in.

4. h = 1.9 cm.
b = 4 cm.
p = 3.3 cm.
q = 2.3 cm.

5. e = .6 in.

6. ℓ = 1.2 in.
w = .5 in.

7. r = $\frac{3}{4}$ in.

8. 90°

IV. 1. 6 in.

2. $\frac{27}{16}$ sq. in.

3. 7.6 cm.

4. 3.8 sq. cm.

5. 2.16 sq. in.

6. .216 cu. in.

7. 2.9 sq. in.

8. .3 cu. in.

9. 4.71 in.

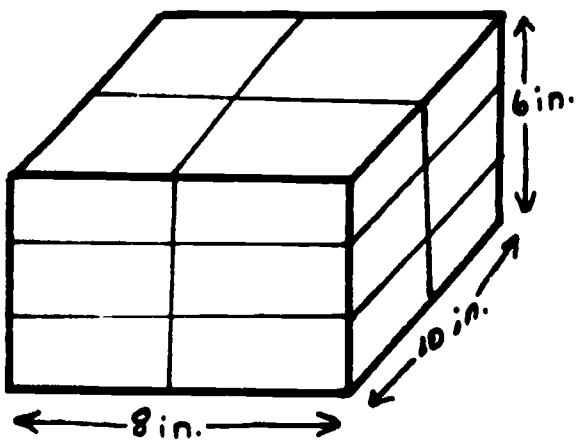
10. 1.77 sq. in.

11. $\frac{1}{4}$

V. 1. $\frac{5}{8}$ (at least)

2. $3\frac{3}{4}$ gallons

4. 12: only 8



5. $37\frac{1}{2}$ miles

6. $3\frac{2}{3}$ yards

7. π = 2.8; careless, because π is greater than 3.

8. $\frac{7}{5}$

9. a. 15 ft.
b. 9 ft.

10. a. 44 sq. ft.
b. 156 cu. ft.
c. No. There are only 17.3 cu. yds.

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   Excellent for reading scales, meters, guages, rulers, protractors. Formulas for area, volume. Includes activities with geometric figures. Basic arithmetic review in back of text. Lab manual available from the publisher (not state adopted).

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   Good for some individualized work identifying geometric figures; finding area of rectangles etc.

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11. Buckeye, Donald; Ewbank, William; and Ginther, John. A Cloudburst of Math Lab Experiments. Volume 2. Birmingham, Michigan: Midwest Publications, 1971.
   Good for estimating problems in measurement, work with geoboards, other activities involving low-cost materials.

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13. Collins, Elizabeth; Nanney, J. Louis; and Rickey, Agnes. Experiencing Mathematics E. New York: The L. W. Singer Company, Inc., 1969.
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